MULTIMEDIA **UNIVERSITY**

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FINAL EXAMINATION

TRIMESTER 2, 2016/2017

EEL2026 – POWER TRANSMISSION AND DISTRIBUTION
(LE)

24 FEBRUARY 2017
9-00am – 11-00am
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 3 printed pages with 5 Questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

(a) State the advantages of High Voltage DC transmission. [5 Marks]

(b) An aluminum conductor is composed of 37 strands each having a diameter of 0.333 cm. Compute the dc resistance in ohms per kilometer at 20°C and 75°C. The resistivity of aluminum $\rho = 2.83 \times 10^{-8}$ Ω-m. What is the ac resistance? If the inner 7 strands are replaced by steel, compute the new ac resistance. [8 Marks]

(c) Explain the following terms as applied to power transmission.
  (i) Characteristic impedance [2 marks]
  (ii) Corona [2 marks]
  (iii) Surge Impedance Loading (SIL) [2 marks]
  (iv) Propagation constant [1 Mark]

Question 2

(a) The conductor of a single-phase 50 Hz line is a solid round wire having a diameter of 0.412 cm. The conductor spacing is 3m. Determine the inductance of the line in mH per km. How much inductance is due to internal flux linkage? Compute the new inductance when the diameter is halved and the spacing is doubled. [7 Marks]

(b) The capacitance per phase of a three-phase 200 km long transmission line having the conductor diameter of d cm is $7.65 \times 10^{-3} \mu F/km$. The spacing between the conductors is 13 m, 15 m and 15 m. Compute the diameter of the conductor and the charging current, if the line is connected to a 50 Hz and 400 kV source. Assume the line is completely transposed. [5 Marks]

(c) The capacitances of a 3-phase cable are 9.0 μF between the three cores bunched together and the sheath and 4.9 μF between one core and the other two connected to sheath. Determine the charging current drawn by the cable when connected to a 3-phase, 50 kV, 50 Hz supply. [8 Marks]

Question 3

(a) A 132-kV, three-phase transmission line is 50 km long. The line has a per phase inductive reactance of 1.0 Ω/km and negligible resistance. Determine the reactive power supplied to a load if the voltages at the two ends are maintained at 132 kV while delivering 50 MW. Compute the sending end reactive power. [8 Marks]

(b) The generalized constants of a 50-Hz transmission lines are A = 0.989 + j0.0012, B = 6 + j54 Ω and C = -2.497 x 10^{-7} + j4.0575x10^{-4} S. The line delivers 200 MVA, 0.8 lagging power factor at 220 kV. Determine the voltage, power and power factor at the sending end of the line. Also calculate the voltage regulation. [12 Marks]

Continued...

Question 4

(a) There are 4 discs in an insulator string having capacitance value of 10C for each disc. The pin to earth capacitance of each disc is C. The voltage across the string is 33 kV. Determine the percentage increase in voltage across each insulator if the insulator connected to the pole is short circuited. Draw the diagram showing potential distribution across the discs.

[12 Marks]

(b) An overhead conductor is supported by a string of suspension insulators having three similar discs. The voltage across the disc unit connected to the line is 16 kV and that across the middle unit is 12 kV. Determine the string efficiency. [8 Marks]

Question 5

(a) List the factors affecting the selection of the ratings of a primary feeder. [4 Marks]

(b) 11-kV voltage is applied to a three-phase distributor having R = 3 Ω and X = 4 Ω per phase. At the end of the line is a balanced load of P MW at 0.6 power factor leading. At what value of P is the load voltage being equal to supply voltage? [6 Marks]

(c) A single-phase AC distributor fed at end A is loaded as shown in Fig Q5. The loop resistance and reactance per km are 0.4 Ω and 0.2 Ω respectively. Determine the voltage drop in the distributor and voltage at the far end if V$_s$ is 240∠0° V. [10 Marks]
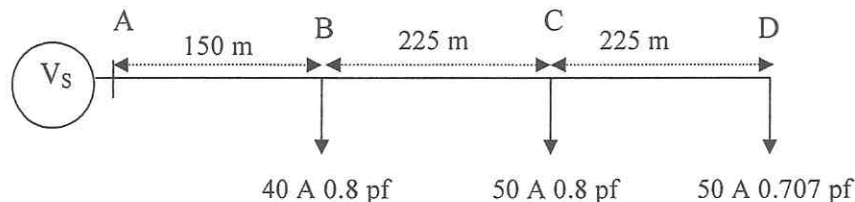

Fig.Q5

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